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The American FERTILIZER

Vol. 106 MARCH 8, 1947 No. 5

Materials Used as Fertilizers

By A. L. MEHRING,[1] *Senior Chemist*

Division of Soils, Fertilizers, and Irrigation Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland

VARIOUS publications give the total consumption of fertilizers and of nitrogen, phosphoric acid and potash in the United States. It is of interest to know what kind of materials are used to supply these plant nutrients, because the availability of the nutrients to plants varies with the source, some materials also supply secondary or minor element nutrients, and for various other reasons.

The quantities of the different materials used as commercial fertilizers in the years from 1850 to 1920 by decades and annually from 1925 to 1937 are already available.[2] The purpose of this paper is to supply similar data for later years and to bring the subject up to date as nearly as practicable.

The tonnages of materials believed to have been consumed as commercial fertilizers in the years 1938 to 1945 inclusive, are given in Table 1. Some data taken from the earlier publication are included for comparison. In the original figures the tonnage included all material consumed in manufacturing and the exports of mixed fertilizers were deducted at the bottom of the table. In the present case an allowance is made for exports in the form of commercial mixtures in the figures in the table. The tonnages of superphosphates and wet-mixed base goods, as well as all other materials in this table, are calculated on the as-is basis rather than on the 18 or 45 per cent basis, as is often done.

The tonnages[3] of limestone in this table include only the quantities used in manufacturing fertilizers, which were estimated by subtracting resales of unmixed liming materials to farmers by fertilizer manufacturers from the total quantities sold to them, as reported to us, by primary producers. Practically all of the limestone used in the manufacture of fertilizers since 1937 was dolomitic.

A study of Table 1 shows that important changes have occurred from 1938 to 1945. Not only has total consumption nearly doubled, but the sources of the various nutrients have changed. The balance between chemical and natural organic nitrogen has been altered. The relative importance of the various phosphates, potash salts and fillers has also shifted.

The decline in the usage of high-grade organics, such as animal tankage, dried blood,

[1] Thanks are due Herbert Myers, Henry Taylor and W. C. Cope, War Production Board, and Mrs. Agatha V. Kobs, Civilian Production Administration, for the use of unpublished data on the allocations of chemical nitrogenous materials.

[2] Mehring, 1939 yearbook of Commercial Fertilizer. 32–41.

[3] Larger than those published for the same years by Dr. Bowles in the limestone chapters of Minerals yearbooks.

TABLE I.
U. S. CONSUMPTION OF COMMERCIAL FERTILIZER MATERIALS, 1938–1945
(1000 Tons)

Material	1910[1]	1920[1]	1930[1]	1938	1939	1940	1941	1942	1943	1944[1]	1945[2]
Chemical Nitrogen											
Ammonia and solutions	..	..	66	110	127	150	182	123	208	322	327
Ammonium nitrate	..	..	..	..	..	..	..	..	114	310	271
Ammonium sulphate	135	373	611	588	602	652	670	830	834	905	964
Calcium cyanamide	3	18	94	90	95	80	116	90	80	73	118
Sodium nitrate	224	298	586	680	695	760	880	644	885	875	1,084
Other nitrates[3]	..	18	62	87	80	59	40	15	20	9	1
Other chemical N[4]	..	..	18	78	87	79	40	20	36	65	110
Organics											
Castor pomace	17	23	40	47	69	65	89	85	66	90	80
Cotton seed meal	444	447	205	136	133	115	150	68	45	53	60
Fish scrap	90	110	74	57	50	34	49	12	6	7	11
Guano and manures	39	57	145	65	52	32	37	44	77	66	169
Sludge, Activated	..	..	32	58	59	64	116	108	96	85	93
Sludge, Other	2	..	8	25	35	40	44	45	47	50	55
Tankage, Animal	226	209	68	60	55	60	45	15	10	10	10
Tankage, Garbage	119	139	74	30	25	20	15	17	16	15	15
Tankage, Process	3	20	129	84	90	93	90	112	105	101	88
Other organics[5]	64	53	42	46	46	43	54	41	36	19	25
Phosphates											
Ammonium phosphates	..	20	48	74	70	67	68	57	46	87	91
Base goods, Wet-mixed	298	377	167	156	150	136	130	124	91	51	35
Basic slag, Open-hearth	25	10	24	36	40	55	65	70	75	112	175
Bone meal	139	170	94	85	75	55	37	33	18	11	20
Superphosphate, Double	10	18	92	201	267	339	295	230	155	227	180
Superphosphate, Normal[6]	2,558	3,020	3,751	2,866	2,954	3,438	3,949	4,855	5,654	6,173	6,582
Other phosphates[7]	1	20	18	16	11	14	14	13	10	5	11
Potash											
Cotton hull ashes	2	1	2	15	20	15	12	3	3	6	5
Kainite	447	414	124	..	..	..	..	..	..	..	..
Manure salts, 20%	116	332	370	83	24	34	..	..	..	..	..
Manure salts, 25%	..	..	..	2	9	10	110	154	190	190	136
Manure salts, 30%	15	15	30	25	14	8	3	..	3	1	1
Muriate of potash, 50%	137	135	286	208	135	134	94	74	122	105	110
Muriate of potash, 60%	..	..	49	319	449	490	560	685	759	796	990
Sulphates[8]	55	20	94	88	62	69	70	96	149	140	121
Tobacco stems	56	70	79	90	92	95	100	103	105	108	115
Other potash[9]	86	120	18	20	21	20	18	18	11	14	18
Miscellaneous											
Gypsum	..	..	..	70	90	100	105	140	180	435	425
Limestone and dolomite	30	46	79	279	324	331	381	376	442	496	503
Magnesia	..	..	..	..	2	4	6	4	6	10	9
Other Mg materials[10]	..	..	..	23	14	9	9	9	12	11	14
Minor element[11]	..	..	2	15	20	21	25	31	35	75	75
Nitrophoska, etc	..	5	13	9	4	2	1	..	..	..	..
Peat, humus and peanut hulls	37	63	54	80	75	80	80	75	75	70	70
Phosphate rock	..	2	39	121	142	156	196	240	248	309	477
Other filler	257	631	720	636	627	628	658	672	664	743	671
Total	5,635	7,254	8,407	7,758	7,993	8,656	9,607	10,331	11,734	13,330	14,315

[1] Revised. The previously published data were given on a slightly different basis before 1938. The data include the territories and Government distributed materials.
[2] Preliminary.
[3] Calcium nitrate, potassium nitrate and nitrate of soda-potash.
[4] Ammonium nitrate-limestone mixtures, urea, calurea, ammonium phosphate-nitrate, etc.
[5] Cocoa shells, tung meal, linseed meal, apricot seed meal, etc.
[6] As manufactured. The superphosphate sold to farmers contains a part of the double superphosphate and a part of the limestone shown elswhere in this table.
[7] Calcium metaphosphate, precipitated bone, spent bone black, phosphoric acid, etc.
[8] Sulphate of potash and sulphate of potash-magnesia.
[9] Cement dust potash, vegetable potash, wood ashes and potassium carbonate.
[10] Calcined brucite, epsom salt, kieserite, magnesite, selectively calcined dolomite, etc.
[11] Aluminum sulphate, borax, ferrous sulphate, copper sulphate, manganese sulphate, zinc sulphate, etc.

cotton seed meal and fish scrap, which began during World War I, has continued until such usage is approaching the vanishing point. The bulk of the tonnages of natural organic nitrogen is now supplied by dried manures, sewage sludge, process tankage, and castor pomace. All of these latter materials were of little importance in the fertilizer picture 30 years ago, as may be seen in the table. Thus in most cases, the farmer that buys water-insoluble nitrogen today gets a product with different properties from that he bought a generation ago. The consumption of ammoniacal solutions has nearly trebled and conditioned ammonium nitrate, a new material, has become a principal source of nitrogen in just a few year. The annual consumption of ammonium sulphate, calcium cyanamide and nitrate of soda has increased. The tonnage of none of these three materials has increased nearly as much as has that of nitrogen, however.

Superphosphate, as judged by relative tonnage, has been the most popular commercial fertilizer material for nearly a hundred years and still is. The usage of wet-mixed base goods and of bone meal is declining rapidly. The consumption of double superphosphate had been increasing rapidly before the war, but the war temporarily reduced it. There were two reasons for this. First, large quantities of phosphorus that would normally have been used in making double superphosphate were used in the manufacture of incendiary bombs and other munitions. Enormous quantities of double superphosphate were shipped to Great Britain instead of ordinary superphosphate to save shipping space. It is likely that the consumption of double superphosphate will increase considerably in the near future.

The greatest change among the potash materials is the rapid growth in the consumption of 60 per cent muriate. The usage of this material started about 1920. It has more than tripled in the past 8 years. Now the bulk of all potash is supplied by this one material. Kainite has disappeared completely from the market and 20 per cent manure salts has almost vanished, although up until 20 years ago these two materials supplied the bulk of all fertilizer potash.

The use of gypsum as a fertilizer has increased tremendously in recent years. The presence of dashes in the table before 1938 does not mean that none was used in these years but that no satisfactory data were available. As far as gypsum is concerned it was relatively small from 1910 to 1930 compared with present usage. Most of the recent growth in usage occurred in California. The consumption of ground phosphate rock as a separate fertilizer material has also increased rapidly in recent years. Most of this increase is accounted for in one state also, Illinois. In fact, Illinois now uses more commercial P_2O_5 than other states.

A considerable shift has occurred in the kinds and relative proportions of fillers in mixed fertilizers in recent years. Although the use of dolomite nearly doubled from 1938 to 1945, the physiological acidity of mixed fertilizers increased from about 30 pounds of calcium carbonate per ton in 1938 to over 100 pounds in 1945. The reason for this fact is that more nitrogen per ton and relatively more acid-forming nitrogen were used in making mixed fertilizers in the latter year. The use of minor element materials, particularly manganese sulphate, has greatly increased in recent years. The above changes, plus the fact that the average grade of mixed fertilizers was raised very markedly during the war, have decreased the relative proportion of inert filler in mixed fertilizers. The total plant food content rose from 19.22 to 21.65 per cent in the average commercial mixed fertilizer during this time and the inert filler decreased from about 240 pounds per ton to 142 pounds. The quantity of peat and peanut hulls consumed remained about constant, but since the tonnage of mixed fertilizers greatly increased, the relative consumption of organic conditioners decreased. Two reasons are probably responsible for this decrease. The rapid increase in the average plant food content of mixed fertilizers in the Southeastern States reduced the necessity for adding any kind of fillers. It has been learned that, although peanut hulls are a good conditioner, they decrease the efficiency of fertilizers in promoting crop yields.

Chase Bag Transfers Radcliffe to Detroit

The recent transfer to the Detroit Staff of V. F. Radcliffe, New York Sales representative of the Chase Bag Company, has been announced by R. N. Conners, Company Vice-President and General Sales Manager.

With the exception of wartime service as an Army Air Force Major, Mr. Radcliffe has represented the Chase New York Sales Office since 1940. shortly after his graduation from Washington and Lee University. In accepting the new appointment, Mr. Radcliffe carries with him a thorough knowledge of the bag business and packaging problems.

Our Land and Its Care

By CLIFTON A. WOODRUM
President of the American Plant Food Council, Inc.

The subject I have chosen for tonight, "Our Land and Its Care," may seem prosaic and uninteresting, but I can assure you it is not only most timely but, in my judgment, fascinating.

One criticism that can be made of the average businessman today is that he is a specialist—he seeks to become proficient in his own avocation and often stands in danger of having only the most superficial knowledge of what goes on around him. Our international contacts and our social and economic way of life is becoming more and more complex. That means we of the business world must continually reach out for a more comprehensive understanding of what makes the wheels go around. In line with that thought, I shall speak to you tonight about our land—about Mother Earth.

Our Land

There are about 1,800,000,000 acres of the earth's surface. A little more than half is devoted to farms including grazing lands. The remainder is in public and private forest lands; parks and other reservations; desert swamp and rocky dunes or in cities and towns.

But of the about a billion acres in farms, only about one-third is harvested for crops—and from this fertile acreage comes our tremendous productive capacity.

Thus, we have about 900,000,000 acres of farm land on which to raise all our food and fibre and to support our animal population.

This means that for every man, woman and child in the United States, there are three to four acres of cultivated land and about the same amount of grazing land, or a total of six to eight acres for each one of us.

While agriculture is still our basic and greatest industry, less than 25 per cent of our population is employed in farming. A hundred and fifty years ago 90 per cent of our people were required for this purpose. The genius of American agriculture has expressed itself in increased production per man rather than production per acre. This is fortunate, for it accounts for our great industrial and commercial development.

American Agriculture

The genius of American agriculture in the critical days through which we have passed and through which we are passing, has done a remarkable job in producing food and fibre not only for America, but for many unfortunate peoples of the world. Agriculture is America's first industry. Today our national welfare is largely dependent upon the progress and prosperity of agriculture. The American farmer occupies a position of great responsibility in our national economy. Agriculture will play a vital role in helping to restore a world which has been torn apart by a devastating war. The American farmer is a businessman and we should treat him as such. He knows that what is good for other American business is good for agriculture.

Mother Earth

Much is being said nowadays about soil building and soil maintenance. It seems to me that mankind is suddenly becoming very conscious of his obligations to Mother Earth. What a mother she has been. With characteristic unselfishness, she has fully given of her treasure for our health, our pleasure, and our progress.

We have trampled her ruthlessly under our feet. We have referred to her scornfully as "dirt"—a thing to be despised and detested. We have neglected her, robbed her, left her to be blown away by the desert winds and washed away by the flood—and yet, good old Mother Earth has gone right on, giving us the ores, marble, rock and timber, oil and minerals with which we have built our agriculture, our cities, our highways, our transportation lines, our implements of peace and war. Giving us from her body food and drink that sustains life, and sending to us from her bosom the beautiful blossoms and foliage to cheer our weary footsteps along

* An address before the Junior Chamber of Commerce at Roanoke, Virginia, February 25, 1947.

the way and to speak of life eternal in that last hour when we return "ashes to ashes" and "dust to dust." Ah, sirs, let us pledge anew our loyalty and devotion to so great a "Mother." Let us as we feast upon all of the good things she produces for our comfort and pleasure be grateful enough to bring back to her and to scatter her with those vital elements so necessary to her life, vigor and continued productivity.

The Care of Our Land

Vitamins for Mother Earth—yes, that's the slogan today, and a most timely one. This brings me to a point in my remarks where I shall, with becoming modesty, I hope, acquaint you with some of the things we are trying to do to care for our land, and to save this most priceless heritage.

The American Plant Food Council, of which I have the honor to be President, is a group of individuals and associations who produce and manufacture plant food and plant food materials. This is sometimes called fertilizer! This great industry is dedicated to the service of American agriculture and the perservation and conservation of our land. May I tell you something about this industry?

Fertilizer Industry

The history of the American fertilizer industry has been characterized primarily by consistent and expanding cooperation with Federal, State, and other agricultural agencies, and with the manufacturers of agricultural machinery, equipment and supplies, to the end that its vast productive capacity might be devoted in ever increasing degree to the formulation of products designed and tested to assure maximum efficiency and economy after delivery to the farm.

The remarkable success with which this traditional policy has been carried out is attested by the Government's data showing (1) that over a period of years, the actual plant food content of fertilizers has been steadily increased, despite a corresponding reduction in prices to farmers; (2) that steady progress has been made from year to year in improving and adapting fertilizer formulae to the crops and conditions for which they are intended, and (3) that in outstanding shortages of farm labor, machinery, and other equipment and supplies, American farmers, aided largely by increased output of improved and more efficient plant food products, were able fully to meet their tremendous war-time task of food, feed and fibre production, and each year of the war period to achieve new all-time yield and production records.

True, technological improvements, such as new and improved crop varieties and more efficient and economical methods and practices were important factors, but without the huge production of American fertilizer factories, estimated at 14½ million tons in 1947, the war itself probably would have been lost, due to the inability of American farmers to cope with their unprecedented assignment without it. Obviously, the ability to measure up to this mighty job, the knowledge of the plant food requirements of many crops, and how to formulate and compound the fertilizers containing them was not gained overnight. The industry had not waited until the emergency exploded in its face to equip itself with a first hand "dirt" understanding of all the facts and problems involved in the successful handling of its assignment. That part of the job had been undertaken long before. Each problem had been studied and re-studied in detail in laboratory, greenhouse, and field. Each method and process, every formula, had been tested and proved and re-tested with such thoroughness and effectiveness that, according to Dr. R. M. Salter, Chief of the Bureau of Plant Industry, Soils and Agricultural Engineering, unless through research, new, profitable uses can soon be developed for the products of the American fertilizer industry, it may become necessary to shut down part of its capacity and return to the pre-war basis of operations when production was little more than half what it is now.

Research

Research and demonstration have been twin keystones of the industry's long and ceasless effort to improve its products and to inform and educate farmers regarding them. These have not been the industry's only activities by any means, but they are the foundation for the far flung and effective campaign the industry has waged to discover and teach farmers how its products can and/or should be used to obtain maximum yields and quality, which are essential to profitable farming.

Thus, in cooperation with the U. S. Department of Agriculture, the Agricultural Experiment Stations, The American Society of Agronomy, and similar societies, the Association of Farm Machinery Manufacturers, bag manufacturers, and other organizations, the American fertilizer industry has long sought to solve farmers' plant food problems

(Continued on page 26)

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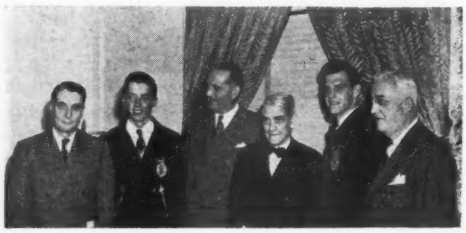
Vol. 106 MARCH 8, 1947 No. 5

Principal Articles in This Issue

Plant Food Vocational Booklet Formally Presented

On February 10th, Clifton A. Woodrum, president of the American Plant Food Council, formally presented "Our Land and Its Care," a 64-page story of "our soil and how to keep it productive," to officials of the U. S. Office of Education for use by the Nation's 300,000 vocational education leaders and students.

Honored guests at the presentation ceremony held at the Mayflower Hotel in Washington were Senator Arthur Capper, chairman of the Senate Agriculture Committee; Rep. Clifford R. Hope, chairman of the House Agricultural Committee; Rep. Frank B. Keefe, member of the House Appropriations Committee, in addition to William G. Carlin of R. D. 4, Coatesville, Pa., "Star Farmer of America"; Gus R. Douglass, Jr., of Grimms Landing, W. Va., National President of the Future Farmers of America and officials of the U. S. Office of Education.



At "Our Land and Its Care" Presentation

Left to right: Representative Clifford R. Hope, Chairman of the House Agriculture Committee; William G. Carlin, Coatesville, Pa., "Star Farmer of America"; Representative Frank R. Keefe, Wisconsin, Chairman of the House Sub-committee on Labor-Federal Security; Senator Arthur Copper, Kansas, Chairman of the Senate Agriculture Committee; Gus R. Douglass, Jr., Grimms Landing, W. Va., National President of Future Farmers of America; Clifton A. Woodrum, President of the American Plant Food Council

In addition to the staff, the Council was represented by A. Lynn Ivey, president of the Virginia-Carolina Chemical Corporation, Richmond; G. F. Coope, president of the Potash Company of America, New York City; F. W. Heidinger, vice-president of Bennett & Clayton Co., Inc., Prospect Plains, N. J. and Horace M. Albright,

president of the U. S. Potash Company, New York City.

Dr. W. T. Spanton, chief of the Agricultural Education Service of the U. S. Office of Education, who received the publication on behalf of the vocational leaders and students, said that he and his staff "are . . . very appreciative of the fact that the American Plant Food Council has seen fit to select the rural public secondary schools of the United States, where 4-year courses of systematic instruction in vocational agriculture are offered and active chapters of the Future Farmers of America are maintained, to be the beneficiaries of its first major educational project; namely, its new publication entitled, 'Our Land and Its Care'."

Dr. Spanton referred to the publication as "one that can be read understandingly by the layman and also used with profit by our teachers of vocational agriculture in their instructional programs with Future Farmer members, as well as in short-unit intensive evening classes organized for young and adult farmers."

Mr. Woodrum, in making the presentation, referred to "Our Land and Its Care" as an

F. W. Heidinger, Vice-president of Bennett & Clayton Co., Prospect Plains, N. J.; A. Lynn Ivey, President of Virginia-Carolina Chemical Corporation, Richmond, Va.; G. F. Coope, President of Potash Co. of America, New York City

answer to the needs voiced by vocational leaders for a "simple text dealing with intelligent land use and management in relation to plant foods."

Both Douglass and Carlin also expressed appreciation for the publication, emphasizing its contribution to the "future of farming." Douglass said the use of "Our Land and Its Care" would be worth "millions of dollars" to vocational students throughout the Nation, adding that such a publication would have "helped me considerably" in building the type of farm program essential to a self-sustaining agriculture.

Potash Company of America Announces New Prices

On March 1st, the Potash Company of America announced a new schedule of prices for the period from April 1 to May 15, 1947:

Muriate of potash, 60% K_2O minimum, 40 cents per unit K_2O, f.o.b. Carlsbad, N. M.

Manure Salts, 22% K_2O minimum, 20 cents per unit K_2O, f.o.b. Carlsbad, N. M.

Both prices are for bulk shipment in minimum car lots of 40 tons.

The "ex-vessel" price basis has been discontinued for the above period.

Wamesit Co. to Make Nitrogenous Tankage

The Wamesit Chemical Company, of Wameset, Massachusetts, has recently been incorporated and will start the manufacture of nitrogenous tankage during March. The incorporators are Kenneth L. Rue and John J. Grady, both formerly connected with Smith-Rowland Co., Norfolk, Virginia., and Lloyd E. Conn, an attorney. The offices are: Kenneth L. Rue, President and Treasurer; John J. Grady, Vice-President and Assistant Treasurer; Lloyd E. Conn, Secretary.

The Company will manufacture a high grade product analyzing 8 per cent to 10 per cent ammonia. The plant, which is the only one producing this material in the New England area, will have an annual capacity of 12,000 tons.

Bickerton Joins Walker Fertilizer Staff

Dr. J. M. Bickerton, for the past six years assistant manager and Director of Research of the Insecticide Division of Innis, Speiden & Company, New York, has joined the Walker Fertilizer Company, Orlando, Florida, in a technical sales capacity.

Dr. Bickerton, who has specialized in soil fumigation work and the development of insecticides, fungicides, nemacides and herbicides, studied at the University of British Columbia in Vancouver. He received his Ph.D. in Plant Pathology from Cornell University in 1940.

Walker Fertilizer Company represent several large manufacturers of fumigants, fungicides and insecticides in Florida, Cuba and Puerto Rico.

Wisconsin 1946 Fertilizer Sales Set Record

Wisconsin farmers set a new all-time record in the purchase of commercial fertilizers during 1946, according to W. B. Griem of the feed and fertilizer section of the state department of agriculture.

Sales during the year totaled 306,939 tons, as compared to 264, 940 tons in 1945, Griem's tabulation shows. This is an increase of about 42,000 tons, or 16 per cent, and represents an expenditure of more than $10,000,000. It is interesting to note that during the depression year of 1933, only 16,311 tons of fertilizer were used in Wisconsin, while earlier sales levels were never over 50,000 tons.

Sales during the fall months again showed a marked increase, totaling 89,852 tons as compared to 62,416 during the fall season in 1945.

In spite of the large volume sold, supplies failed to meet the demand during the year. Supplies will also be short this year, Griem said, but indications are that by the fall of 1947 production will be sufficient to meet the demand.

Griem's tabulation shows that during 1946 Wisconsin farmers purchased 177,604 tons of complete mixed fertilizers, as compared to 148,673 tons in 1945. Sales of phosphate and potash mixtures increased from 57,477 tons in 1945 to 64,074 tons. Sales of superphosphates climbed from 40,588 tons in 1945 to 48,498 tons last year. Sales of other fertilizer materials totaled 16,763 tons as compared to 18,202 tons in 1945.

The report further shows that the 2–12–6 formula again tops the list in sales, with a total of 73,178 tons as compared with 57,966 tons a year ago. The 3–12–12 formula was second with 70,770 tons and 3–18–9 in third place with 10,645 tons. Sales of 20 per cent superphosphates totaled 46,343 tons as compared to 30,201 tons in 1945.

In the phosphate and potash mixtures, the 0–20–10 formula lead with a total of 18,048 tons. In second place was the 0–14–7 formula with 17,757 tons, while 0–12–12 was third with 14,948 tons.

DuPont Ammonia Promotes Keenen

Dr. Frank G. Keenen has been appointed assistant sales manager of the Nitrogen Products Section Sales Division of the DuPont Company's Ammonia Department. J. H. Daughtridge is sales manager of the section.

For more than two years, Dr. Keenen has been a member of the Technical Service Section of the Ammonia Department's Sales Division and has been concerned principally with field research and the development of uses for synthetic urea in fertilizers and dairy and cattle feeds.

In 1926, Dr. Keenen joined the DuPont Company as a chemist at the Belle, W. Virginia, plant where synthetic ammonia is made by the fixation of atmospheric nitrogen. After two years there, he joined the Ammonia Department research group at the Du Pont Experimental Station in Wilmington and, since that time, he has largely been concerned with product development and sales service work.

He is a member of the American Society of Agronomy and of the Plant-Food Research Committee of the National Fertilizer Association. In 1945, he was a member of the Chemical Control Committee of the National Fertilizer Association and chairman of that committee in 1946.

FERTILIZER MATERIALS MARKET

NEW YORK

No Change in Tight Situation in the Fertilizer Materials Market. Organic Prices Lower but Still above Fertilizer Range. Not Much Foreign Material Expected. Government Aiding Shipments of Chilean Nitrate of Soda

Exclusive Correspondence to "The American Fertilizer"

New York, March 3, 1947.

By way of repetition, it can only be reported that in general the fertilizer materials market remains very strong in view of continuing demand from mixers and the shortage of available supplies to meet this demand. Organic materials have weakened somewhat due to lack of buying interest in the feed trade, but prices remain above fertilizer levels. In order to obtain the more urgently needed items some manufacturers are reported to be trading materials.

There have been no imports of fertilizer materials at this port during the past two weeks, and except for shipments of French potash to be made next month, foreign supplies are not anticipated in time for the spring season.

Ammonium Sulphate

This material remains as tight as previously in spite of capacity production. Continuing active buying interest is unfilled.

Nitrate of Soda

Increased demand for spring application has brought about an even shorter supply situation. Government assistance in bringing additional supplies from Chile to this market is expected to ease the critical shortage for top dressing.

Organic Materials

Trading level on dried blood is reported to be at $8 ($9.72 per unit N), with very little interest at this figure. Bone meal has moved in small volume to the feed trade at $75 per ton f.o.b. and remains beyond the reach of most fertilizer manufacturers. There have been recent offerings of hoof and horn meal from abroad in the market at $160 per long ton, c.i.f., with no takers.

Superphosphate

In this area the market is extremely tight with no resale material being offered. Price schedule is exceedingly firm and will undoubtedly continue at present levels during the current fertilizer year. Triple superphosphate is in even shorter supply due to production difficulties at the plant of one of the major producers.

Potash

The expected announcement of the end of government potash allocations has finally been published. Controls by CPA have been revoked as of February 17th. Producers are contracting for the April-May period with demand far in excess of anticipated production.

CHARLESTON

Mixers Beginning to Exhaust Materials Supplies. No Prospects of Additional Materials above Previous Estimates

Exclusive Correspondence to "The American Fertilizer"

Charleston, March 1, 1947.

Deliveries of mixed goods are well ahead of schedule and some manufacturers are almost at the bottom of their materials supplies. Shortage of all prime ingredients is widespread and demand remains tremendous.

Organics.—Interest in organics by fertilizer manufacturers is rather slack as most buyers have secured their expected requirements and others are watching the weakened vegetable meals market for possible lower levels. South American packing-house products remain higher than domestic levels. European imports are practically nil.

Castor Pomace.—Shipments are going forward against contracts and no new business is reported.

Hoof Meal.—Indications of price are around $8,00 to $8.50 per unit ammonia ($9.72 to $10.33 per unit N) at Chicago. Interest light.

Blood.—Quoted around $7.75 ($9.42 per unit N) Chicago and market is quiet. Some moves to the feed market.

Tankage.—Wet rendered tankage is around $6.50 ($7.91 per unit N) f.o.b. Chicago. Interest slack.

Nitrate of Soda.—This article continues extremely short from both domestic and import sources. Relief is expected in March but much will arrive too late for maximum good this season.

Sulphate of Ammonia.—Short in supply, long in demand; market extremely tight.

Ammonium Nitrate.—The committee from the House of Representatives has recommended that the War Department immediately return approximately 100,000 tons borrowed from private producers and that in future ammonium nitrate for use in occupied areas be only shipped from plants operated by the Army. The market situation at present is extremely tight and supply short of demand.

Potash.—The Government has released control of potash, but deliveries in the last quarter of this present season are expected to be 50 per cent less than the same period for the last season.

Superphosphate.—Demand remains strong and supply is inadequate to satisfy, due to shortage of sulphuric acid, and delay in delivery of rock caused by car shortages.

Phosphate Rock.—Market tight and deliveries are hampered by car shortages. Recent rise in crude oil price to producers of rock has resulted in a slight increase in price of rock to consumers.

PHILADELPHIA

Mixed Fertilizer Shipments Increasing. More Organics on Market but Prices Uninteresting to Fertilizer Manufacturers

Exclusive Correspondence to "The American Fertilizer"

Philadelphia, March 3, 1947.

Shipment of mixed fertilizer to dealers and growers is now in full swing, and buying interest continues in all fertilizer chemicals, with the supply inadequate. Organics are more readily obtainable but do not seem to excite much buying interest.

Sulphate of Ammonia.—Substantial tonnage is now moving and the production is said now to be far ahead of last year.

Nitrate of Soda.—The demand continues active with present supply far below the requirements. However, increased importations are expected soon.

Castor Pomace.—With increased importation of castor beans it is hoped there will be more pomace available soon.

Blood, Tankage, Bone.—Tankage and blood are a little more free, with the feeding trade showing little or no interest—a situation which the fertilizer mixers seem slow to recognize, as on a counterbid they might pick up an occasional organic bargain. There has been more interest shown in bone meal, with no price reduction.

Fish Scrap.—Several offerings of fish meal appeared on the market at prices too high for the fertilizer man and drawing no extra interest from the feeders.

Phosphate Rock.—The demand continues for more than can be produced, and the car shortage is a problem.

Superphosphate.—both the production and and the consuming demand have been higher than during the previous year, and the demand still continues much ahead of the supply.

Potash.—Government regulations have been lifted and the demand still continues unsatisfied. The expected importation from France during the next three months, of something over sixteen thousand tons will afford little relief. A very great deal more than this is needed.

CHICAGO

No Prospect for Improvement in Fertilizer Organics. Feed Material Market Easier

Exclusive Correspondence to "The American Fertilizer"

Chicago, March 1, 1947.

Western fertilizer organics remain in status quo—offerings being practically nil while inquiry continues fairly active. The trade cannot forsee any favorable change in this situation in the near future.

Wet rendered tankage has not been brisk, last sales being at $7.50 per unit ammonia ($9.12 per unit N). Unground blood is nominally $7.75 to $8.00 per unit ammonia ($9.42 to $9.72 per unit N), at $67.50 f.o.b. shipping point.

Canadian Potash Deposit Discovered

Discovery of a deposit of potash salts in southern Saskatchewan, Canada, was recently announced by J. L. Phelps, Saskatchewan Resources Minister. No details have been given as to the extent of the area proven, which is in the Unity oil field about 100 miles northwest of Saskatoon. While the potential

production is said to be large, the beds are deep in the ground and mining would be costly. Saskatchewan officials estimate that an outlay of $4,000,000 for shafts and a mill would be necessary and Minister Phelps is quoted as saying that government enterprise "was the only feasible way of developing production of this mineral."

The location of the deposit is such that the haul to most fertilizer centers would be longer than from United States potash sources, and it would therefore not be a present source of competition in the domestic market.

Organic Gardening Reaching Out

Organic gardening is a new method of gardening as advocated by many who have tried the system in this country and abroad. The use of organic matter in gardens is not new, however. What is new in this method is the method of composting, which dispenses with all chemicals except lime. Those who advocate this new method of gardening also claim commercial fertilizers harm the soil and they suggest there is no need for seed treatments nor dusting or spraying for pest control.

Donald Comin of the Ohio Agricultural Experiment Station, Department of Horticulture, points out that although the use of composts and organic matter is highly recommended for gardens, that experimental results show that when commercial fertilizers are used in connection with organic matter in any form that the yields are usually greater than when either material is used alone. Furthermore, when commercial fertilizers are used properly they are beneficial, not detrimental, to garden soils or crops. The actual results obtained from any soil treatment for gardens varies considerably depending upon the soil, seasonal conditions, and the crop being grown.

Experiment Station authorities suggest that a soil anaiysis be made of any garden soil so that the owner may know the fertility level of his soil, and what ingredients in what amounts will benefit the soil and crops he contemplates planting. They also suggest that a compost will decompose most rapidly and benefit the soil and crop most when a mixture of finely-ground limestone and fertilizer chemicals supplying available nitrogen and phosphorus are mixed with the composting materials, especially when manure is not available.

About one pound per cubic yard of compost

Accent on Sanitation

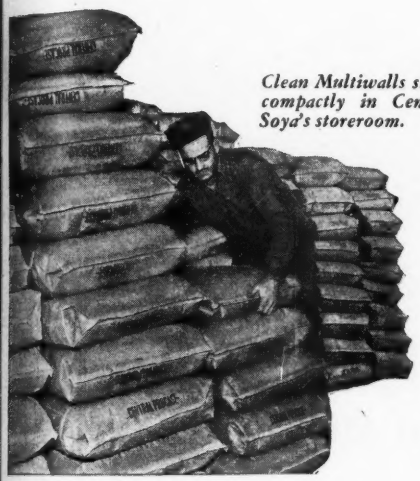
PAYS DOUBLE DIVIDENDS

To the Central Soya Company, Inc., a sanitary package is a vital factor in the sale of its soya flour—one of the many soybean products made in one of the company's three Mid-Western plants.

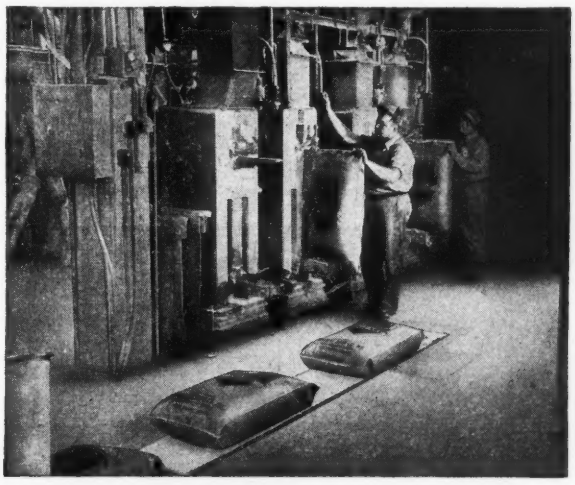
This company, whose executive offices are in Fort Wayne, Indiana, formerly packed its flour in fabric bags. Recently it adopted a St. Regis Packaging System consisting of four 100-LS bag-filling machines and multiwall paper valve bags. Clean, fresh-looking Multiwalls won immediate approval from customers. They commented that these dust-free containers assured more effective protection against contamination and infestation. Untouched by human hands, Central Soya's flour today enjoys an enviable reputation for cleanliness.

In addition to better sanitary protection, the new system paid an extra dividend in the form of important economies in containers, labor costs, and in unit packaging costs, as shown graphically on the page at the left.

Thus, the company achieved two important objectives — more sanitary packaging and a substantial saving in costs. The savings alone, typical of economies provided by St. Regis systems, explain why manufacturers in many industries have adopted this modern packaging method. Mail the coupon for the complete picture story of this efficient, economical operation.



Clean Multiwalls stack compactly in Central Soya's storeroom.



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of a mixture containing 45 per cent of sulfate of ammonia or cyanamid, 15 per cent of superphosphate, and 40 per cent of finely-ground limestone is suggested for making composts.

Sugar Beets Need Special Fertilizers

Michigan farmers who are shopping for fertilizers now should remember that sugar beets need special fertilizers. This timely advice comes from Dr. C. E. Millar, head of the department of soil science at Michigan State College. Sugar beets are particularly sensitive to shortages of available phosphate, and are also large users of potash.

On typical dark-colored clay loam soils, about one-half as much potash as phosphoric acid has proved suitable. For the better silt and clay loams that are well supplied with humus, 2–16–8 is recommended. Due to the present shortage of fertilizer materials, it may be necessary to use 2–16–2 in many localities. Also recommended are 4–16–8 and 4–16–4. On lighter loams more potash is needed and the percentage of phosphoric acid and potash in the fertilizer should be about equal. A 3–12–12 is an excellent grade.

Ohio Crops Need Fertilizer

Liberal use of fertilizer on crops planted in Ohio and acceptance of fertilizer deliveries when they can be made are advised by Ohio State University agronomist Earl Jones. He says to use 0–14–7, 2–12–6, or 4–12–8 for corn and oats on land which has not been manured and 0–12–2, 3–12–12, or 4–12–8 on those crops if manure has been applied.

Recent tests have indicated fertilizer can be used profitably on oats at a rate of 300 to 500 pounds per acre except on ground where oats are likely to lodge. Oats are not so likely to go down in seasons after plenty of rain or snow has fallen during the winter so Ohio oats should stand up well in 1947.

Fertilizer should be used on Ohio corn under all conditions. Mr. Jones advises applying at least 150 pounds per acre on corn planted in hills and applications of 250 to 300 pounds per acre on drilled corn. Plowing down nitrogen has given increased yields but the increase is affected by drought, poor land drainage, or poor tillage practices.

Established alfalfa fields pay well for fertilizer applications. The fertilizer should be applied in winter or early spring at a rate of 250 to 300 pounds of 0–14–7 if the land has

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been manured regularly or of 400 to 500 pounds of 0–12–12 where little or no manure has been used on crops preceding the alfalfa. Only one application in each two years is advised.

Mr. Jones also suggests putting fertilizer on bluegrass and Ladino clover pastures. Ladino clover needs the same treatment as alfalfa. For bluegrass, the recommendations are 400 to 500 pounds of 20 per cent phosphate where manure has been used or the same amount of 0–14–7 with no manure. Applications are made every fourth year in fall, winter or early spring.

Caspari Appointed Davison Phosphate Sales Manager

The Davison Chemical Corporation of Baltimore announced the appointment of William Caspari to the position of General Sales Manager of the Phosphate Rock Division, Bartow, Florida.

Mr. Caspari began his career with Davison thirty-one years ago in the Chemical Laboratory. He has successfully served in various capacities in the corporation's fertilizer and chemical operations and has spent a number of years on the corporations' properties in Cuba.

In addition to his duties as General Sales Manager of Davison's Phosphate Rock Division at Bartow, Florida, he is General Sales Manager of the Superphosphate and Export Divisions.

Mr. Caspari has made extensive studies of foreign markets. He directed the first sale and shipment of superphosphate in bulk from the United States to a South American port.

Mr. Caspari is well known in the dry mixed fertilizer and acidulator trades, and also in the phosphate rock industry.

Sales of phosphate rock, superphosphate and export sales will be cleared through Davison's home office in Baltimore, Maryland.

Topdress Alfalfa, Says Virginia Agronomist

Recent experiments show that alfalfa fertilized at seeding, but not topdressed in succeeding years, produced only one-half as much as that fertilized at seeding and dressed regularly thereafter, according to H. L. Dunton, head of the agronomy department at Virginia Polytechnic Institute.

Further, the hay of topdressed alfalfa contained less weeds and was far superior to the alfalfa not topdressed.

Most farmers in the State have cut heavy yields of alfalfa during the past several years. This means, says Mr. Dunton, that large amounts of plant food have been removed, and if the alfalfa stand is to remain satisfactory, it must be fed by proper application of plant food.

Fertilizer Abstracts

Papers presented at the 1946 meeting of the Fertilizer Division, American Chemical Society

Acid Pyrophosphate and Metaphosphates Produced by Thermal Decomposition of Monocalcium Phosphate

W. L. Hill, S. B. Hendricks, and E. J. Fox, Bureau of Plant Industry, Soils, and Agricultural Engineering, Beltsville, Md.

Information on the products formed by heating monocalcium phosphate at temperatures below 600° C. has a practical significance in connection with the thermal treatment of superphosphate to produce mineral feed of low fluorine content. The primary purpose of this study was to determine the compounds that are formed under various heating conditions and to obtain physical constants adequate for their identification. Chemical methods involving preparation, analysis, and solution in water and citrate solution were used together with X-ray diffraction, differential thermal analysis, and petrographic microscopy. Four crystalline compounds—calcium acid pyrophosphate and three low-temperature monotropic modifications of calcium metaphosphate—and an amorphous phase were recognized and identified.

Monocalcium phosphate monohydrate is known to undergo partial fusion when it is heated rapidly in the open at 150° to 200° C. The resultant horny mass, usually a mixture of compounds, is converted to stable beta-calcium metaphosphate at 600° to 700° C. Fusion can be avoided by first heating the charge at 125° C, to expel water of crystallization, but further heating in the range 200° to 600° C. yields an unpredictable mixture of phases, consisting of glasslike amorphous material and one or more of at least three crystalline phases. On the other hand, the anhydrous salt, obtained either by drying the hydrate or by crystallization from solution, readily loses water in an atmosphere of steam at 275° to 300° C. and changes smoothly into calcium acid pyrophosphate with the formation of little or no amorphous material. An essentially pure amorphous material can be prepared by heating extremely thin flakes of monocalcium phosphate monohydrate. At 350° C. in steam crystalline acid pyrophosphate is converted into a mixture of two low-temperature modifications of calcium metaphosphate with more or less amorphous material, which, being soluble in water, can be leached from the insoluble crystalline compounds. Formation of a third crystalline metaphosphate is enhanced by the presence of sulphate. This modification is structurally similar to, and apparently forms a solid solution with, anhydrous calcium sulphate (anhydrite).

Effect of the Saturation of Acid-Alcohol with Potassium Chloroplatinate in Determination of Potash in Fertilizers

M. A. Ewan and O. W. Ford, Purdue University Agricultural Experiment Station, Lafayett., Ind.

An examination of the results of potash determinations made by the Official Method for Potash in Fertilizers, 2.42 (a), of the Methods of Analysis, A.O.A.C., Sixth Edition, 1945, indicates that slightly higher values are obtained where the acid-alcohol is saturated with K_2PtCl_6. Determinations were made on samples with a K_2O content ranging from 8 to 27 per cent. In addition, the effect of using K-free normal sodium acetate in place of K-free normal NaOH was investigated.

Methods, Technique, and Interpretation Results Used in Testing Soils in North Carolina

Ivan E. Miles, N. C. Department of Agriculture, Raleigh, N. C.

Soil testing has progressed very rapidly during the last few years and is today accepted as a very good tool in arriving at and maintaining a sound liming and fertilization program. The purpose of this paper is to show the methods, technique, and equipment used in testing soils and the interpretation of the results obtained in the North Carolina Testing Laboratory.

Equipment has been designed and is herein described which enables two persons to analyze 1000 samples (aggregating 3500 tests) in a week. This is accomplished by measuring reagents, shaking, and filtering in batteries

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of from 8 to 36 samples simultaneously, and is done without sacrifice in accuracy.

Phosphorus is determined with ammonium molybdate and stannous oxalate; potassium, with sodium cobaltinitrite; calcium, with sodium oxalate; and magnesium, with Titan yellow. Organic matter is determined by a modification of the Walkley and Black procedure, and pH is determined with a glass electrode pH meter.

The results of the tests, which have been calibrated with field results, together with information supplied by farmers; the Experiment Station recommendations, and a knowledge of the soils and crops concerned enables an agronomist very greatly to improve the lime and fertilizer recommendations in any specific case.

OUR LAND AND ITS CARE

(Continued from page 11)

through research into many fields, which, though differing in detail, are all more or less related at least in the attainment of the final ultimate objective. In this research, the question is not simply how much fertilizer should be used and how and when it should be applied. That is merely an approach to the beginning of the serious effort toward a solution of true and often hidden problems.

1. Is it a fertilizer for bright tobacco, for example?
2. How much nitrogen should such a fertilizer contain?
3. What kind of nitrogen?
4. What sources and how much of each should be used?
5. How much potash?
6. What kinds and how much of each?
7. Chlorine?
8. How should the customary methods of fertilizing corn be revised for the new hybrid varieties, with closer spacing?
9. What is the new economic limit to nitrogen side-dressings on corn?
10. Can the fertilizer program be adapted to prevent injury from seasonal and climatic ab normalties?
11. Do fertilizer recommendations generally call for too little or too much phosphate?
12. What are the best sources of phosphate for different purposes?
13. Is dolomite the sound solution of the acidity problem resulting from the use of acid-forming materials in formulating complete fertilizers?
14. Is it possible to reduce damage and loss from plant diseases and insect infestation by improved fertilizer practices?
15. Which of the plant food elements is most effective in this connection?
16. Under present day conditions, are N, P and K sufficient for any crop?
17. What crops need boron, manganese, etc?.
18. Is the high or low phosphate program best for the citrus grower?
19. Is sodium a true plant nutrient?
20. To what extent can it replace or substitute for potash in fertilizer programs and combinations?
21. In what manner and to what extent do fertilizers affect or influence the nutritional qualities of food and feed plants?
22. What elements are important in this respect and which are essential?
23. Is the source of the materials a consideration in this connection?
24. How should the fertilizer program be adjusted to meet the requirements of the winter grazing program?
25. How can fertilizer manufacturing processes be modified to permit the efficient utilization of new forms of nitrogen as they become available?
26. When hygroscopicity is a problem, how can good mechanical condition be maintained?
27. Should the nitrogen for small grains be applied in the fall or the spring, or both?
28. Is potash side-dressing on row crops profitable, or should it be applied at or before planting?
29. In what position in the soil should fertilizer be placed?
30. Is satisfactory machinery and equipment available for the proper application of fertilizers?
31. On certain crops, is fertilizer best applied in the soil, as a spray, or in solution?
32. What maximum concentration of plant food nutrients can be permitted in a fertilizer formula without danger of injury to the crops?

These are typical of the problems with which the industry in its laboratories and with its technical staffs has long been dealing. Similar questions arise everyday and must be solved with the least delay.

Cooperate with Agencies

The industry's cooperation with Federal and State scientists has gone much further, however. Research men on both sides have maintained close, effective contacts in dealing

with every problem involving the manufacture and use of fertilizer. Complete sets of recommendations governing the fertilization of every crop grown in the State have been compiled by the Agricultural Experiment Stations in the various States. These recommendations are based on the results of research work and represent usually the joint views of the agronomists and fertilizer men as to the most practical and economical fertilizer program for the farmers of the State, whatever their individual circumstances and conditions may be.

To achieve the maximum results the total number of grades has been very substantially reduced and today the fertilizer manufacturer is no longer obliged to make up scores of analyses, varying only fractionally from each other. Instead, he is able to concentrate on a dozen formulae more or less, as recommended by the Experiment Station. For competitive advantage he must rely, ultimately, upon his ability to furnish, within the limits of the list of recommended grades, better fertilizer more economically than his neighbor. To accomplish this, no one has yet found any substitute for experience.

Test Demonstrations

In disseminating the results of its research work and the improved practices resulting therefrom to the farming public, the industry has long employed the farm demonstrations as the major feature of its educational program. Annually, for many years, hundreds, probably thousands of well-conducted field scale demonstrations have been established throughout the agricultural areas to provide visual evidence of the better results to be obtained from proper use of improved fertilizer products. To assure official control and general acceptance of the evidence provided by the demonstrations they are conducted usually, in cooperation with county farm agents, or with agricultural instructors in rural vocational schools. The demonstrations are conducted in accordance with good farm practice in every respect, and meetings and tours are arranged to attract attention and to stimulate interest in them.

Similarly, in cooperation with the county farm agents and vocational instructors, the industry has long engaged in contest activities, arranged for the boys and girls in 4-H Clubs and in agricultural classes. Suitable awards are offered as prizes, usually taking the form of scholarships in the State Agricultural Colleges. Occasionally boys who have won such a scholarship, paying the cost of from one to four years of undergraduate work, have been awarded upon graduation, one of the research fellowships that are maintained at the various agricultural research institutions by the industry.

Every other known means of conveying the fertilizer story to farmers has been employed at one time or another. Excellent motion pictures have been produced covering a wide range of subjects, all designed to instruct the farmer in the important and proper use of plant food on whatever crop he grows, and whatever his conditions may be. In all of its activities, however, the industry has endeavored to emphasize its full cooperation and support of the official agricultural agencies. Its constant effort has been to make their program its program, believing that the net result of its procedure in that respect will be to effect the maximum benefit to the consumers of its products.

This industry, ladies and gentlemen, has served American agriculture well and shall in the future be ready and able to supply the American farmer with the plant food which he shall require for the efficient use and conservation of his land.

I have sought to give you in simple layman's language the story of "Our Land and Its Care." America owes her position of world leadership to her soil. The power, wealth and vigor of our people are directly due to the marvelous productivity of our land. We must not neglect our soil.

Small Acreage Gives High Yield When Fertilized

J. C. Rapp of McArthur, Arkansas, is convinced that a small acreage of corn well fertilized and cultivated will give a better yield than a large acreage not fertilized, reports Desha County Agent Leo D. Wylie.

Mr. Rapp set his goal at 100 bushels of corn per acre this year. He used 500 pounds of 6-8-12 fertilizer per acre before planting, and then side-dressed with 200 pounds of ammonium nitrate per acre. The acreage produced 90 bushels of good corn.

Mr. Rapp plans to plant 20 acres of corn next year and again have as his goal 100 bushels per acre. He plans to turn under a crop of winter legumes, apply two tons of lime and then use 500 pounds of 6-8-12 fertilizer under the corn and side-dress it with 200 pounds of ammonium nitrate. Use of the fertilizer, lime and winter cover crops was recommended by the soil laboratory of the University of Arkansas College of Agriculture.

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BUCKETS—Elevator
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARS AND CARTS
Hough Co., The Frank G., Libertyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Utility Works, The, East Point, Ga.

CHEMICALS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill
McIver & Son, Alex. M., Charleston, S. C.
Virginia-Carolina Chemical Corp., Richmond, Va.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Wiley & Company, Baltimore, Md.

CONDITIONERS
American Limestone Co., Knoxville, Tenn.
Keim, Samuel D., Philadelphia, Pa.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
McIver & Son, Alex. M., Charleston, S. C
Schmaltz, Jos. H., Chicago, Ill.

CYANAMID
American Agricultural Chemical Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.

DRYERS
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

FERTILIZER (Mixed) MANUFACTURERS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
International Minerals and Chemical Corporation, Chicago, Ill
Virginia-Carolina Chemical Corp., Richmond, Va.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
McIver & Son, Alex. M., Charleston, S. C.

FOUNDERS AND MACHINISTS
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Utility Works, The, East Point, Ga.

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Stedman's Foundry and Mach. Works, Aurora, Ind.
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IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.

INSECTICIDES
American Agricultural Chemical Co., New York City.
McLaughlin Gormley King Co., Minneapolis, Minn.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.

LOADERS—Car and Wagon
Hough Co., The Frank G., Libertyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making and Handling
Chemical Construction Corp., New York City.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Utility Works, The, East Point, Ga.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Company, Boston ,Mass

MACHINERY—Elevating and Conveying
Hough Co., The Frank G., Libertyville, Ill.
Hayward Company, The, New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MACHINERY—Grinding and Pulverizing
Bradley Pulverizer Co., Allentown, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sedberry, Inc. J. B., Franklin, Tenn. and Utica, N. Y.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MACHINERY—Material Handling
Hayward Company, The, New York City.
Hough Co., The Frank G., Libertyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MACHINERY—Mixing, Screening and Bagging
Exact Weight Scale Co., Columbus, Ohio
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.

MIXERS
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.

NITRATE OF SODA—Continued
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
DuPont de Nemours & Co., Wilmington, Del.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PHOSPHATE ROCK
American Agricultural Chemical Co. New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Virginia-Carolina Chemical Corp., Richmond, Vc.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
Schmaltz, Jos. H., Chicago, Ill.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City.
Potash Co. of America, New York City.
International Minerals & Chemical Corp., Chicago, Ill.
United States Potash Co., New York City.

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Utility Works, The, East Point, Ga.

ROUGH AMMONIATES
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
McIver & Son, Alex. M., Charleston, S. C.
Scar-Lipman & Co., Inc., New York City.
Schmaltz, Jos. H., Chicago, Ill.

SCALES—Including Automatic Bagging
Exact Weight Scale Co., Columbus, Ohio
Sackett & Sons Co., The A. J., Baltimore, Md.
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SCREENS
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Sturtevant Mill Company, Boston, Mass.
Utility Works, The, East Point, Ga.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
McIver & Son, Alex. M., Charleston, S. C
Schmaltz, Jos. H., Chicago, Ill.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Schmaltz, Jos. H., Chicago, Ill.

UREA
DuPont de Nemours & Co., E. I., Wilmington, Del.

UREA-AMMONIA LIQUOR
DuPont de Nemours & Co., E. I., Wilmington, Del.

VALVES
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Utility Works, The, East Point, Ga.

Alphabetical List of Advertisers

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